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Original Articles

Reflexology and bronchial asthma

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Many asthma patients seek alternative or adjunctive therapies. One such modality is reflexology, whereby finger pressure is applied to certain parts of the body. The aim of the study was to examine the popular claim that reflexology treatment benefits bronchial asthma. Ten weeks of active or simulated (placebo) reflexology given by an experienced reflexologist, were compared in an otherwise blind, controlled trial of 20+20 outpatients with asthma.

Objective lung function tests (peak flow morning and evening, and weekly spirometry at the clinic) did not change. Subjective scores (describing symptoms, β_2-inhalations and quality of life) and also bronchial sensitivity to histamine improved on both regimens, but no differences were found between groups receiving active or placebo reflexology. However, a trend in favour of reflexology became significant when a supplementary analysis of symptom diaries was carried out. It was accompanied by a significant pattern compatible with subconscious unblinding, in that patients tended to guess which treatment they had been receiving.

No evidence was found that reflexology has a specific effect on asthma beyond placebo influence.

Key words: asthma; alternative medicine.

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Introduction

Many asthma patients seek alternative therapies such as reflexology, homoeopathy and chiropractic manipulation (1). Reflexology is a specific treatment whereby finger pressure is applied to certain parts of the body, especially the feet, but also other parts of the extremities and regions on the back. It is claimed that a large number of diseases can be treated, but no anatomical or physiological mechanism of action has been described. Among asthma patients, reflexology is a well-known alternative or complementary treatment, and casuistic reports about a positive effect are known among patients. However, the effect has so far never been documented. On the contrary, one randomized, controlled clinical trial failed to demonstrate significant differences in symptom and medication scores or lung function between a control group and a reflexology-treated group, whereas a marked improvement was observed during the study for both groups (2). Since asthma is characterized by asymptomatic periods amongst periods with symptoms, spontaneous improvement as well as outright placebo effects are expected (3). Consequently, controlled investigations are mandatory. A randomized, double-blind, controlled trial was designed, comparing active with simulated (placebo) reflexology, with the aim to study its effect on bronchial asthma assessed by clinical symptoms, medicine intake, objective lung function parameters, bronchial sensitivity and quality-of-life questionnaires.

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Materials and methods

SUBJECTS

Forty patients aged 18–60 years with a forced expiratory volume in 1 sec (FEV_1) greater than 60% of the predicted value were included. The asthma diagnosis was established by an increase in FEV_1 of more than 15% after inhalation of a β_2-agonist, and/or airway hyper-responsiveness to histamine defined as a 20% decrease in FEV_1 after inhalation of a histamine concentration (PC_{20} for histamine) of no more than $2\,mg\,ml^{-1}$. Patients used short-acting β_2-agonists and were allowed to use inhaled steroids less than 2000 μg per day if the dose was constant for more than 4 weeks prior to the study and during the trial, whereas no systemic steroids were allowed 6 weeks prior to the study. No other anti-asthmatic treatment was allowed. Subjects were excluded if they experienced airway infections during a 6-week period before the study started. Patients with interfering seasonal asthma were likewise excluded, as were patients who could not co-operate or suffered from

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neuromuscular diseases or other chronic diseases expected to interfere with the investigation. Finally, pregnancy or planned pregnancy was an exclusion criterion. All patients had two feet and a normal peripheral neurological status. Drop-out was defined as hospitalization or marked changes in regular medication as well as withdrawal of informed consent. The study was approved by the local Ethical Review Committee for Copenhagen and Frederiksberg and complied with the Helsinki 2 Declaration. Patients were included only after informed consent.

DESIGN

The trial was randomized, double-blinded, and placebo-controlled. After 2 weeks of baseline registration of symptom and medication score (see section on diary cards) a total score of at least 7 points per week was mandatory for inclusion. Asthma severity was graded as either low: 7–14 points per week, or high: 15 points or more. The patients were then randomized to receive either simulated (placebo) (n=20) or active reflexology (n=20) by a computer-generated 'minimization' method (4), taking gender and severity of disease into account. The randomization code was given only to the reflexologist in separate, sealed envelopes for each patient by a technician otherwise not involved in the study. After all 10-weekly treatments, the patients were asked to guess which treatment they thought they had received (active, placebo or 'don't know') in order to assess the efficacy of the blinding.

REFLEXOLOGY REGIMEN

All patients received 10 treatments of 45 min once a week by the same qualified, trained reflexologist in a specially allocated room at the Allergy Unit. The patients were treated in an almost supine position in a designated chair. Special areas of planta pedis bilaterally were treated for approximately 2 min at each point. Then, with the patient prone, pressure was applied at special points on the extremities and back. Then the patients returned to the chair, where a relaxation technique was applied lasting approximately 10 min. Simulated reflexology was given in a similar way using 'placebo' areas on the feet, extremities and backs, the active areas being avoided.

DIARY CARDS

The patients kept diary cards throughout the whole investigation (Fig. 1), recording: self-measured peak flows, the best of three measurements (Mini Wright Peak Flow Meter, Airmed, Harlow, U.K.) and symptom score on a scale of 0 (no symptoms) to 4 (worst symptoms), as well as β_2-agonist use when necessary. Data were recorded in the morning immediately after getting up and in the evening. The diary cards were checked and replaced at each visit. In the first week of the pretreatment period, patients were trained how to complete the diary cards and measure peak flow: thereafter registration was made during 2 weeks of baseline, 10 weeks of treatment and 2 weeks post-treatment (Fig. 1).

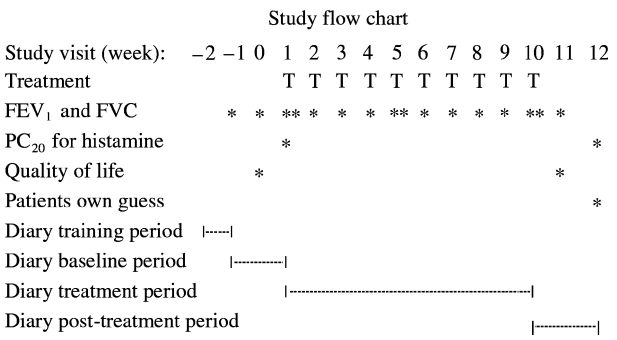

FIG. 1. Study flow chart. T =treatment-session. * Indicates that the test was performed once; **indicates that the test was performed before and after treatment session. Week X follows visit X.

LUNG FUNCTION MEASUREMENTS AND BRONCHIAL HISTAMINE CHALLENGE TEST

Forced expiratory volume in 1 sec and forced vital capacity (FVC) were recorded at each study visit, according to Fig. 1. At visits one, five and 10 the lung function was measured not only before, but also after, reflexology in order to assess any immediate effect. Percentages of predicted values (5) were used in the calculations.

Bronchial sensitivity was measured as PC_{20} for histamine before reflexology treatments started and 1 week after the last treatment (Fig. 1) according to Cockroft (6). Short-acting β_2-agonists were withheld for 6 h prior to testing; inhaled steroids were not withheld.

QUALITY OF LIFE

Quality of life was assessed before and after the treatment period by a standardized questionnaire, SF-36 (7). The questionnaire was scored according to the guidelines (8), results being expressed on the eight standard SF-36 scales.

ANALYSIS OF DATA

Patients' daily registration of symptoms, medication, and morning peak flow 7 days before the first treatment (baseline week) and 7 days after each of the 10 treatments were used for the calculation of a daily mean for that week. Depending on the variable, the individual response of a patient was calculated relatively $[(X_{after}-X_{before})/X_{before}]$ or absolutely $[(X_{after}-X_{before})]$, or 'semi-relatively' $[(X_{after}-X_{before})/1/2(\sqrt{X_{before}}+\sqrt{X_{after}}) = 2(\sqrt{X_{after}}-\sqrt{X_{before}})]$. Analyses in terms of relative change are substantially influenced by those with low scores (due to division by near-zero), whereas analyses in terms of absolute changes can be dominated by only few 'dramatic' symptom or medication scores. The semi-relative change represents the

geometric mean of absolute and relative change and also portrays the change of the square root value. It is deployed here in an effort to equalize responsiveness over the spectrum of severities.

Where the patient's guess as to treatment arm is subjected to a trend test or used as an outcome predictor, 'don't know' is treated as located midway between 'active' or 'placebo'. Paired, unpaired, and regression-type *t*-tests are used as appropriate. Tests with two-sided, *P*-values $<5\%$ are reported as significant, explicit *P*-values being reserved for key comparisons.

Results

Twenty patients were randomized to active treatment: 12 women and eight men (mean age 39·0 years, range 22–56), and 20 patients to simulated reflexology: 13 women and seven men (mean age 38·3 years, range 24–54). Four patients with low and 16 with high symptom medication scores were allocated to both treatment groups. All patients completed the study and received the planned 10 treatments. The treatment period, 63 days in case of perfect compliance, was on average 71·4 days (range 63–105) for the actively-treated, and 73·5 days (range 63–77) for the placebo-treated group. Mainly due to vacations, the interval between two treatments exceeded 2 weeks for five actively-treated and two placebo patients, once each, in the course of the 400 treatments.

SYMPTOM AND MEDICATION SCORES

As some patients needed more than 1 week for training their diary registration, only the last baseline week, where all patients has filled in diaries, was used for calculations. For this reason, a few of the included patients have a '0' registration for either symptom or medication score the last week before treatment.

Patients' weekly average symptom and medication scores (number of puffs of β_2-agonist) were used, as displayed in Fig. 2. Relative changes in symptom and medication scores showed a statistically significant decrease after treatment, visit 10, compared to baseline values, visit 0, in both groups (Fig. 3). However, no statistically difference between the groups was observed.

PEAK FLOW REGISTRATIONS

Weekly averages of morning peak-flow registrations during the study are shown in Fig. 2. The relative change after treatment compared to baseline is illustrated in Fig. 3. A small increase after treatment is found in both treatment groups [actively-treated: median +0·8% (range −16·7% to +40·2%); placebo-treated: median +4·4% (−16·8% to +21·0%)]. However, these changes are not significant, neither when tested as absolute values nor as relative changes. Similarly, evening peak-flows showed small and non-significant fluctuations [actively-treated: median −0·6% (range −14·0% to +25·7%); placebo-treated: median +0·5% (range −10·6% to +24·3%)]. No significant differences between the two groups exist.

LUNG FUNCTION MEASUREMENTS AND BRONCHIAL HISTAMINE CHALLENGE TEST

The weekly FEV_1 used are included in Fig. 2. No statistically significant changes in FEV_1 or FVC were observed during the study, either within or between the groups. Similarly, the FEV_1/FVC ratio showed no significant changes during the study [active group: median −0·4% (range −22·4% to +31·7%); placebo group: median +2·7% (range −14·4% to 12·3%)] and no significant group differences were observed. Measurement of FEV_1 before and after treatment sessions showed no significant immediate effect of reflexology at any visit, either within or between the groups. PC_{20} histamine was somewhat higher before treatment in the placebo group than in the active group (Fig. 4). Within both groups, PC_{20} for histamine increased significantly during treatment. The relative improvement did not reach a statistically significant difference between the two groups (*t*-test on the logarithmic scale employed in Fig. 4).

QUALITY-OF-LIFE QUESTIONNAIRES

The patients' responses to the SF-36 questionnaire were transformed according to the instructions provided by the developer of the questionnaires (8), producing eight dimensions (physical functioning, role limitations due to physical problems, bodily pain, general health perception, vitality, social functioning, role limitations due to emotional problems and general mental health) where quality of life is expressed on a scale from 0 to 100%, the latter representing the optimal situation. All but three patients (who happened to be placebo cases) produced pre- and post-questionnaires. In general, almost all the parameters in both groups improved throughout the study. The active group improved significantly on the dimensions: physical function, (lack of) physical limitations, and vitality, whereas the placebo group only improved on (lack of) physical limitations. Three dimensions showed group inequalities after and, in part, before treatment, but when improvements i.e. before–after differences, were compared, no significant differences between the two groups was detected on any of the eight scales.

SUPPLEMENTARY ANALYSIS

In order to overcome the risk of making a type 2 error and investigate a possible borderline effect of the treatment, several data transformations were tried. A preliminary analysis made it clear that no transformations could change the results of the objective parameters, so only symptoms and medication scores are reported. In order to reduce the dispersion in symptom and medication data, the last 3, apparently stable, weeks of the study were aggregated and

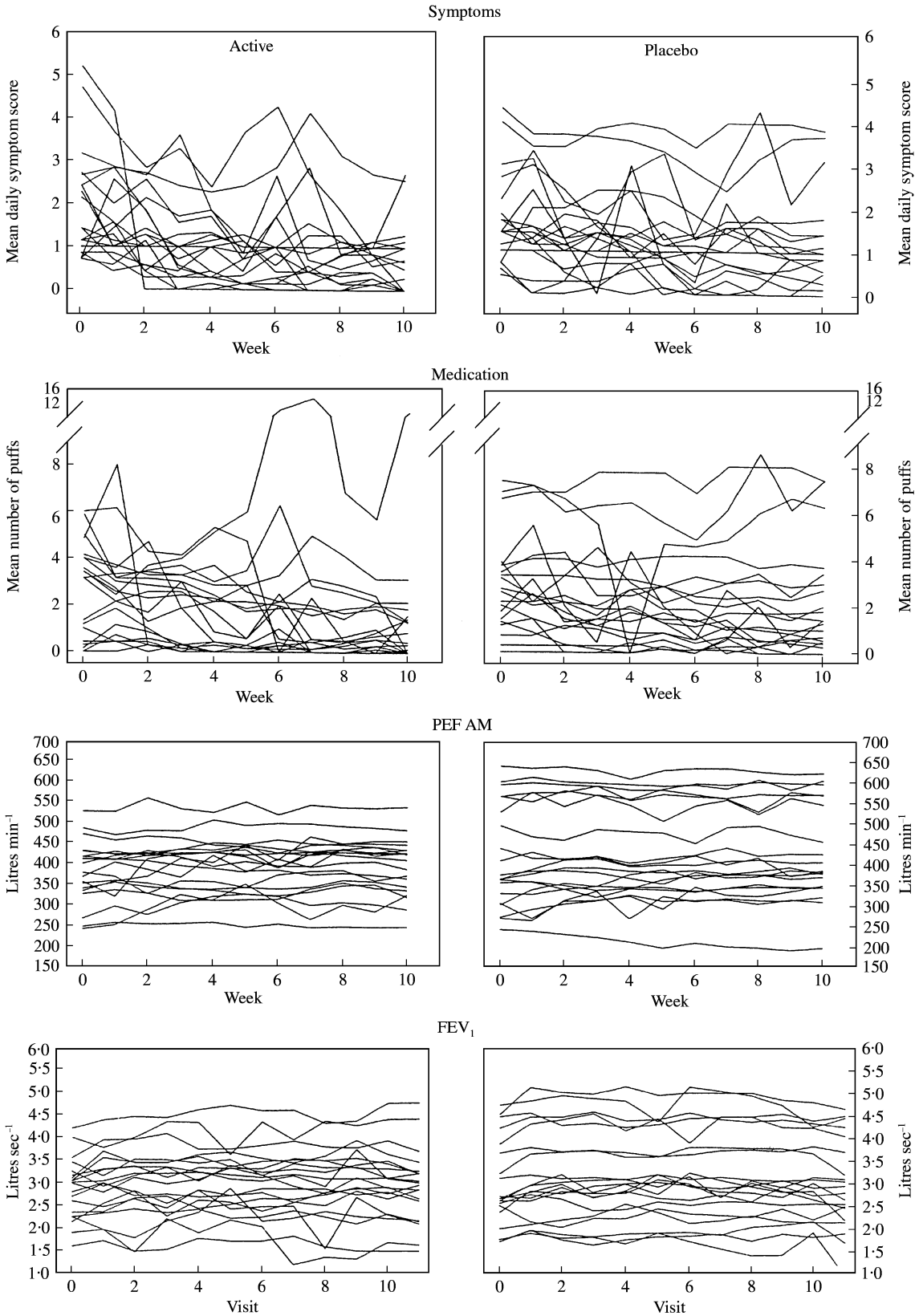

FIG. 2. Individual courses of FEV_1 and the three diary variables [weekly means of symptom score (symptoms), number of puffs of β_2-agonist (medication) and morning peak flow (PEF AM)]. Week 0 is the baseline week succeeded by the 10 weeks following each of the 10 reflexology sessions.

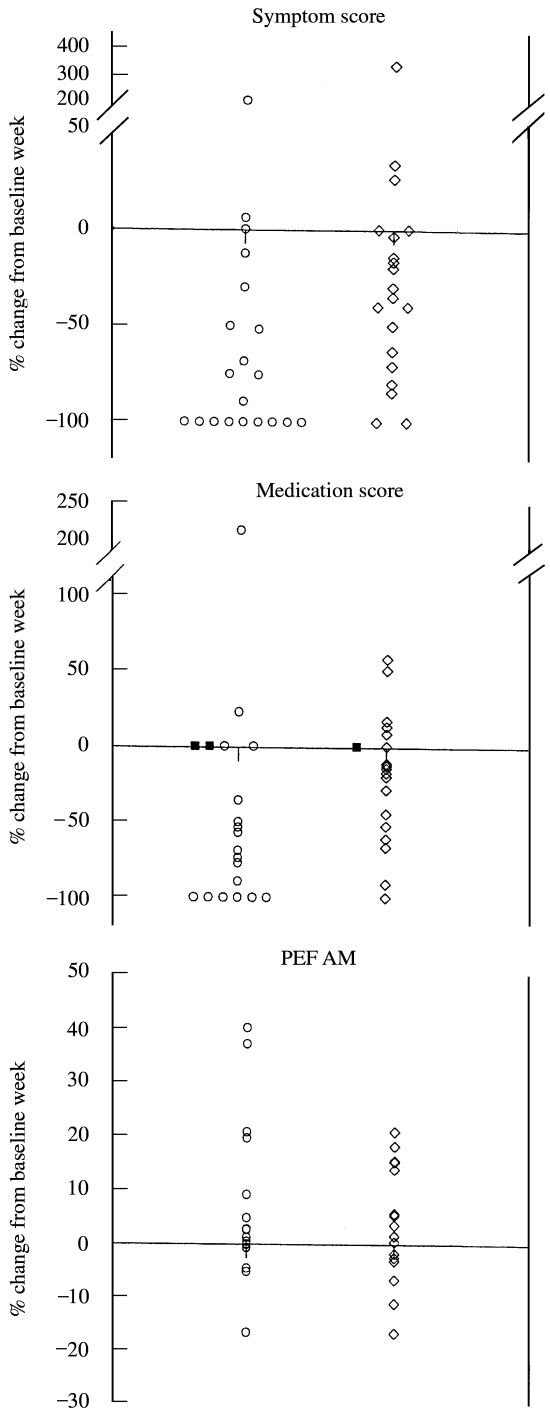

FIG. 3. Relative changes in three diary variables [weekly means of symptom score, numbers of puffs of β_2-agonist (medication score) and morning peak flow (PEF AM)]. ○: active treatment; ◇: placebo. The week after the last treatment is plotted as change relative to baseline week. Three patients marked with black squares in the middle panel took zero medication both in week 0 and in week 10. In both groups, the symptom and medication scores but not the peak flow improved significantly, but no significant differences were found between the groups, in terms of either absolute or relative change.

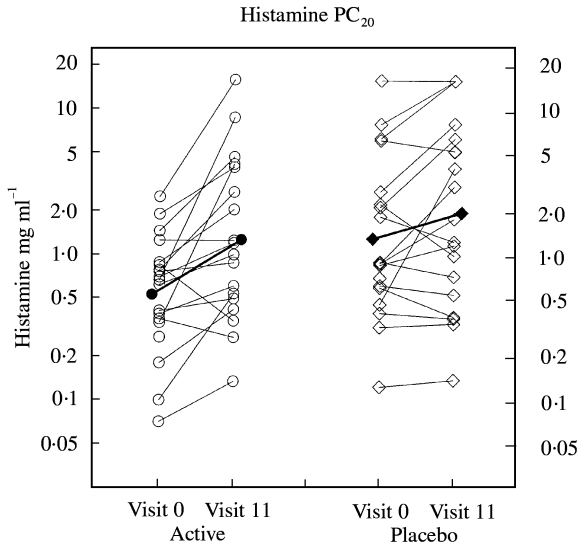

FIG. 4. Histamine sensitivity in the active group (○) and the placebo group (◇) before and after the 10 treatments of reflexology. When 16 mg ml^{-1} failed to induce >20% drop in FEV_1, 16 mg ml^{-1} has been marked in the figure. Geometric means are marked in bold. Within both groups a significant improvement occurred. The placebo group had slightly higher levels than the active group, but the relative improvement showed no significant difference between the two groups.

used as 'post-treatment' values. Secondly, a semi-relative analysis of symptom and medication data was performed for the reasons stated in the Methods section. Additionally, calculations excluding patients with intervals between two treatments exceeding 2 weeks (five actively-treated and two placebo patients), leaving a total of n=33, were performed. Table 1 summarizes the analyses in terms of P-values. For the medication scores, all transformations maintain the difference between the groups as non-significant, whereas the symptoms do appear to have a favourable association with reflexology treatment, although the single very low P-value cannot be taken on face value as it must be regarded as the result of repeated probing into the data set.

THE PATIENT'S GUESS

In the actively-treated group 12 patients guessed that they had received active reflexology, six simulated treatment and two did not know. Among the placebo-treated patients, nine patients guessed that they had received placebo treatment, two active treatment and nine did not know. Participants' guesses thus did not seem to have a preferential direction (despite the fact that nearly everyone improved), but a clear tendency towards correctly guessing the treatment received was apparent [(trend)=2·20, two-sided P=2·8%]. When the guess variable is introduced, the P-values generally increase (Table 1) and only in the semi-relative transformation of symptom scores a significant difference between the active and placebo group remains.

TABLE 1. Stastical differences (*P*-values in %) between active and placebo groups regarding symptom and medication scores using different transformations of data

	All 40 patients				33 patients with uninterrupted compliance			
	Week 10		Weeks 8–10		Week 10		Weeks 8–10	
	SS	MS	SS	MS	SS	MS	SS	MS
Absolute change	5·8	21	5·2	14	1·7	6·2	3·0	12
Adjusted for guess	11	34	12	34	10	26	17	49
Semi-relative change	1·9	7·7	4·6	15	0·46	7·4	3·4	30
Adjusted for guess	3·5	14	10	36	2·7	21	16	83

SS: symptom score; MS: median score.
Supplementary analyses of symptom and medication scores using absolute changes and semi-relative changes from pre-treatment week to post-treatment. Post-treatment values are used either the week after final treatment (week 10) or aggregated data for the last 3 weeks of the study (weeks 8–10). The right part of the table shows the analogous results after exclusion of seven participants whose treatment intervals on one occasion exceeded 2 weeks. Two-sided student *P*-values are shown as %; all changes favour reflexology. The same parameters are shown with adjustment for the participant's guess as to regimen.

Discussion

This placebo-controlled study of the effect of reflexology in bronchial asthma showed a decrease after treatment in the subjective parameters symptom score and asthma self-medication regardless of placebo or active reflexology treatment, but when the data were analysed according to our original protocol no significant differences were found between the groups. The patients' quality-of-life assessments showed some increased scores after treatment, but again no difference was found between the groups. The improvement in the subjective parameters was not supported by objective lung function tests. Bronchial sensitivity decreased significantly for both groups and once again without a treatment difference, perhaps because of better compliance with anti-inflammatory drugs under trial conditions. From this, it was concluded that this study did not show an effect of reflexology as adjunctive treatment to adult patients with bronchial asthma.

A larger study would have had more power to do so. In retrospect, an effect on the symptom score that reduced it from 1·8 (the observed average on the 0–4 scale) to 0·3 on active treatment and to 1·6 on placebo would have enjoyed a power of 80%. The observed active–placebo gap was only two-thirds of that. Corresponding figures for β_2-agonist administration might be: 2·6, 0·5, 1·6 puffs day^{-1}, 80% and one-half respectively.

As the planned analysis of the self-reported asthma medication and symptom-scores (and not lung function data) showed an effect for both groups, it was decided to take another look at these data, in order not to overlook a possible effect of the treatment. In the extended analysis three transformations were used and a significant difference in favour of the actively-treated group was shown for symptom scores, but not self-medication. This trend was most prominent when looking at the groups of patients with uninterrupted compliance. Self-reported symptoms are 'soft' data and may depend on the patient's belief in active or placebo treatment. Unconscious signals from the reflexologist may have influenced susceptible individuals. In this way, a certain un-blinding may have taken place, and this was supported by the finding of a clear tendency for the participants to make correct guesses. The results were corrected for guesses, which weakened most of the significance levels (only semi-relative change at the 10-week registration now showed a significant change at 5% level). Unfortunately, this pattern is open to opposite casual interpretations: either un-blinding leads to subjective convictions that cause reinforced placebo effects (and of course, correct guesses); or a genuine effect induces in a number of correct guesses (in addition to being reflected in favourable symptom scores).

Although the authors believe that the semi-relative transformation is a valid compromise between absolute and relative comparisons, and that it reduces the undesirable influence of extreme data, it must be emphasized that to the author's knowledge, this transformation has not previously been used in data evaluation in asthma trials. Thus, by the standards normally used in clinical trials and according to the data analysis stipulated in the current study's original protocol, it cannot be concluded that the study showed an effect of active reflexology better than placebo. The results address, however, the need for further studies of the relation between reflexology and the subjective feeling of improvements experienced by some patients. A more rigorous blinding should be ensured in further such studies, perhaps by breaking the close psychological contact between patient and therapist.

Even though reflexology is widely used as adjunctive treatment, the authors are only aware of one controlled clinical trial using reflexology in bronchial asthma (2). In that study, 30 patients were randomized to receive 10-weekly treatment sessions of reflexology or to a control group who did not receive placebo reflexology. A

favourable course was demonstrated in both groups, but no effect could be ascribed to reflexology treatment.

Other forms of alternative therapy of asthma have been described (9,10). Chiropractic treatment for asthma has recently been investigated (11). In a randomized, controlled study, 80 children received either active or simulated chiropractic manipulation. A substantial improvement in symptoms and quality of life, and a reduction in β_2-agonist use was observed, but these changes did not differ significantly between the active and placebo groups. No significant changes in objective measurements of airway function were found. In the study mentioned 11 chiropractors participated, and the patients were allowed some latitude due to illness or vacations, but each subject was required to receive between 20 and 36 treatments during the 4-month study.

In the present study fewer patients participated, but all were treated by the same therapist, and all received 10 treatments within, on average, 71 days and 74 days for the two groups, respectively. Even with this strict protocol good compliance was achieved, but subsequent to termination of the study, the reflexologist who took part in scheduling the sessions objected that this degree of compliance was not sufficient. For this reason further analyses were performed in which seven patients with interrupted regimens were omitted. Due to vacations etc., a schedule like the one originally stipulated may be difficult to comply with in everyday life, but *post hoc* exclusions always should be avoided: it is impossible to tell whether the cleaned-up data set is more trustworthy.

In the light of the weak trend for a difference in symptom scores a larger patient sample would have been preferable. The number of patients in the present study may be too low, but if an increase leads to the inclusion of more therapists or longer study period new elements of variance and perhaps a lower compliance may be introduced. On the other hand, if an effect did exist, it should be possible to show it with the number of patients enrolled, judging from published clinical trials with other forms of anti-asthmatic medication (12,13).

Thus, from a clinical point of view, the present study has failed to demonstrate that active reflexology compared with placebo reflexology has a relevant clinical effect on bronchial asthma.

Acknowledgements

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